

3. Do the network parameters used to estimate cost relationships -- traffic loads, peak to busy hour, generic software loads, etc. -- accurately reflect the configuration and usage of BOC's local networks?

The existing review process, however, does not enable a reviewer to answer any of these questions. Key input data were redacted and not subject to any review. The Arthur Andersen study involved an examination of the relationship between the inputs, supplied by each BOC, and the output reported by the BOC. This review did not investigate the accuracy or authenticity of the data supplied.

1. Did each BOC apply costing principles and assumptions consistently across all ONA features?

The "switching primitives" are the fundamental set of inputs of the SCIS model. The switching primitives -- such as CPU cost/millisecond, are basic cost values utilized by the SCIS model to estimate feature costs. Once the primitives are determined, SCIS calculates the cost of a particular feature by determining the quantity of each primitive used by the feature.

In the review process, all intermediate primitive calculations were redacted. As a result, it is impossible to determine if the same cost per millisecond was used for each feature -- much less whether the right cost was applied. Disclosure of intermediate primitive estimates (perhaps under proprietary agreement) is a minimum requirement for an informed review process.

2. Do the underlying switch prices/discounts accurately reflect the prices/discounts paid by the BOC?

Without an independent audit of study input values it is impossible to determine the accuracy of switch price input values. In addition, the vendor discount data field was redacted, making it impossible to determine the extent to which vendor discounts would impact results.

3. Do the network parameters used to estimate cost relationships -- traffic loads, peak to busy hour, generic software loads, etc. -- accurately reflect the configuration and usage of BOC local networks?

Again, without a independent audit of data inputs, it is impossible to determine the accuracy of the input information.

B. The Arthur Andersen Review³⁵

Due to the proprietary nature of the SCIS model and the necessity of using vendor-supplied information, Arthur Andersen was contracted to perform a review of the SCIS modelling process. The useful purpose of the Arthur Andersen review lies in its confirmation that the data and assumptions used by the BOCs as inputs to the SCIS/SCM modelling process do, in fact, yield the outputs reported by the BOCs. In addition, it provides a good overview of the costing techniques utilized by SCIS/SCM and serves to highlight issues which require further investigation.

The review encompassed four areas:

1. Evaluation of the SCIS/SCM methodology.

³⁵Arthur Andersen & Co., Independent Review of SCIS/SCM Report, July 1992 cited herein as "Arthur Andersen."

2. Identification of study parameters subject to variation.

3. Sensitivity analysis.

4. Validation of SCIS/SCM aggregation methods.

Unfortunately, the Arthur Andersen Review has proven deficient in all of these areas. Most importantly, it uses a misleading statistical analysis when attempting to identify the sensitivity of the modelling process to changes in input parameters specified by the BOCs. As the section which follows demonstrates, the analysis in the Review tends to suggest that the cost modelling and ratemaking processes are reasonable while, in fact, the ONA ratemaking process reflects the BOCs' discretionary decisions to a much greater extent than it does any objective analysis of underlying costs.

1. Evaluation of the SCIS/SCM methodology.

Arthur Andersen concludes that "the costing principles inherent in SCIS are appropriate for estimating long-run incremental investments attributable to switching system usage, and the specific methods for implementing these principles are reasonable."³⁶ However, nowhere does Arthur Andersen describe the standards by which the costing principles were evaluated. As noted earlier, use of average costing, overhead loading, and analog switching are inconsistent with estimation of long-run incremental costs. Arthur Andersen, however, makes no mention of any such

³⁶Arthur Andersen, at 7.

inconsistencies which might impact the validity of the study results.

Arthur Andersen does not explain what the underlying principles governing the proper conduct of a long run incremental cost study should be, and does not comment on what impact the prices derived from different costing methods might have on economic efficiency. In fact, with Arthur Andersen's statement that the BOCs' estimation techniques were appropriate, it has apparently concluded that average costing, incremental costing, the aggregation of average and incremental costing,³⁷ use of forward-looking technology or inclusion of analog technology and the use of current and three year old office data are all reasonable and appropriate methods for estimating long run incremental investment costs.

If this much methodological discretion is given to the BOCs, it is difficult to understand how the results of such a study could possibly constrain their pricing behavior in order to achieve the Commission's goals of efficient pricing, non-discrimination, and restraint of BOC monopoly power.

2. Identification of Study Parameters Subject to Variation.

The Arthur Andersen study evaluates the SCIS and SCM models through the use of "sensitivity analysis," which determines the response of the model's outputs to changes in specific input parameters. As Arthur Andersen correctly notes

³⁷As in the case of Ameritech, where Ohio costs were measured by incremental methods while other states had costs measured using the long run average methodology.

"the BOCs have considerable model input options and costing choices under SCIS and SCM."³⁸ It is therefore important to distinguish cost differences which are due to discretionary choices in the costing process from differences due to variations in cost characteristics between the BOCs. If the ONA process is to result in efficient, cost-based rates, BOC input choices should have a minor impact on BSE costs relative to actual underlying differences in cost characteristics among the BOCs.

Arthur Andersen begins this process by identifying parameters which could have a significant impact on model results. It then sets up three classifications of variation which it calls: Source 1 (Differences in Actual Cost Characteristics Between BOCs); Source 2 (Variations due to BOC estimates of unknown parameters); and Source 3 (Variations due to BOC discretionary choices in the costing process).

At first glance these appear to be useful distinctions. However, Arthur Andersen never attempts to quantify variations in SCIS/SCM output resulting from these sources. Thus, for purposes of understanding the SCIS modelling process, these classifications are rendered useless.

3. Sensitivity Analysis

The term "sensitivity analysis" as applied to the Arthur Andersen review of the SCIS/SCM model is potentially misleading. A sensitivity analysis is usually designed to

³⁸Arthur Andersen, at 2.

isolate the effect of changes in a particular variable on overall model results. For example, a sports trainer collects data and models an athlete's performance as a function of diet, age, hours per day spent training and training method. In order to test the impact of a single variable, such as diet, on athletic performance, one could vary diet while holding other factors constant and examine how the results of the model change as diet changes.

In the sense described above, Arthur Andersen has not performed a sensitivity analysis. Instead, "Arthur Andersen sought to determine, for example, how much differences in rates design, costing methodology or data assumptions contributed to the wide range of BSE costs."³⁹ To extend the above analogy, imagine that the athletic performance model data had been collected for a number of athletes. They compete and their relative performances are measured. As in all athletic events there are winners and losers, i.e., there is variability in the athletes' performances. The Arthur Andersen review attempts to explain the variation in the group's performance as a result of variations in the group's characteristics. This would be analogous to explaining variation in an athletic team's performance on the basis of variation in the diets, ages, training schedules, etc. of individual athletes.

Such an analysis does not and cannot isolate the impact of an individual athlete's characteristics on that athlete's

³⁹Arthur Andersen, at 2.

performance. Similarly, the Arthur Andersen "sensitivity analysis" tells the reviewer nothing about how discretionary choices (e.g., marginal vs. average costing) or underlying cost characteristics of a particular BOC affect that BOC's BSE cost estimates.

For example, all of the carriers adopted the same rate structure for ANI services, thus there was no variation in this input. Arthur Andersen reports that there were no differences in costs due to rate design. However, if rate structures had been different, they would have impacted the BOCs' reported costs.

This is a simple example; however, the potential for misunderstanding is magnified as the cases become more complex. To illustrate the problems inherent in this methodology, Arthur Andersen's sensitivity analysis of the ANI BSE is examined below. The discussion concentrates on Arthur Andersen's treatment of key areas involving costing choices by the BOCs.

Marginal Costs vs. Average Costs

Arthur Andersen uses its version of sensitivity analysis to make misleading conclusions about the impact of the choice between average and marginal methodology on the costs of ANI, and incorrectly claims that these conclusions are based on switch architecture. Arthur Andersen states:

. . . [C]osting principles (marginal versus average) are a significant parameter of two BSEs, but have less effect on Calling Billing Number Delivery [ANI] and no effect on Make Busy Key. Calling Billing Number Delivery and Make Busy Key rely more upon special hardware than the central processor of the switch. The central processor is a

primary investment component affected by the difference between marginal and average costing.⁴⁰

While this argument appears logical on the surface, further examination reveals it to be completely erroneous. The apparent lack of impact of changes in costing procedure is not due to any underlying cost characteristics of switching technology or switch architecture. It is solely the product of Arthur Andersen's estimation technique.

Figure 1 is a copy of Arthur Andersen's worksheet for analyzing the sensitivity of ANI costs to changes in costing principles.⁴¹ Note that seven of the nine BOCs surveyed used average costing while only Southwestern Bell and BellSouth used long-run marginal costing. The small magnitude of difference in variance values between the TRP costs and the costs "Restated for Sensitivity Analysis" is due to the fact that the restated values are identical to the initial values in all but two cases. The low variance differences do not imply that costing methodology has no impact -- it merely tells one that nearly all of the BOCs used the same costing technique. In the two cases where costing methodology does change, costs increased by 233% (for BellSouth) and 169% (for Southwestern Bell), respectively. Thus, the choice of costing method has a profound impact on ANI cost results -- switch architecture has no relevance.

⁴⁰Arthur Andersen, at 16.

⁴¹Arthur Andersen, Appendix 23, at 1.

Figure 1

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Arthur Andersen omitted the worksheet explaining the Make Busy Key result from its filing even though it is included in the Table of Contents in Appendix 25 of the review. However, one must suspect the same problem exists for that BSE especially since, in the case of Make Busy Key, only one carrier, BellSouth, used marginal costing.⁴²

To make any statement about the overall impact of costing methodology, one must compare the costs obtained under marginal versus average methodologies for all the BOCs. Arthur Andersen does provide a very brief study of start-up costs based on an average model office at the end of its review which indicates that costing methodology and technology weighting have enormous impacts on BSE cost estimates. The results are presented in Figure 2.⁴³ These are relevant initial calculations and deserve far more weight in the review process; moreover the same types of impacts need to be calculated to determine usage-based cost differences for all BSEs for all carriers.

⁴²Southwestern Bell notes that the Make Busy Key study was undertaken "prior to the availability of the marginal cost option on SCIS." Direct Case, Appendix A.

⁴³Arthur Andersen, at 92, Figure 6G.

Figure 2

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Sensitivity Analysis: Software Version

The Arthur Andersen study of the impact of "software version" on ANI costs is disconcerting in several respects. First, there are two distinct types of software included under this heading:

- (a) The SCIS modelling software itself and,
- (b) The switch generic software.

The impact of different generic software residing in the switch is a reasonable source of cost variation since changes in software can affect processor efficiency and the manner in which a feature is provisioned from a particular switch. Variation that can be attributed to companies using older versions of SCIS -- which, presumably, is updated to make it more (and not less) reliable -- is not a reasonable source of variation. Unfortunately, the inappropriate combination of these two distinct elements into a single analytical category does not allow the reviewer to distinguish between variations due to actual underlying costs (the software generic) and those due purely to each BOC's discretion (SCIS version).⁴⁴

The Arthur Andersen sensitivity analysis itself is also of questionable value. Figure 3 presents Arthur Andersen's worksheets on cost differences due to software version.⁴⁵ It would appear from the variances reported that the "Generic

⁴⁴This arbitrary aggregation is particularly irksome given that Arthur Andersen paid substantial lip service to the notion of separating these sources of variation in setting out its Source 1, Source 2, and Source 3 categories of variation. See Arthur Andersen, at 9.

⁴⁵Figure 3 is taken from Arthur Andersen, Appendix 23, at 1-2.

Used" and "Test Generic" are identical in all cases except NYNEX and Ameritech for the first switching technology tested, and Ameritech alone for the second. Thus, as in the case of the costing method (average compared to incremental) sensitivity study, there is almost no difference in variances between the "Generic Used" and "Test Generic" samples, but only because the variable factors are the same for most of the BOCs.

In addition, the analysis on the worksheet in Figure 3 examines only two switch generics per BOC, while the discussion of technology weighting reveals that, with the exception of Nevada Bell, all BOCs use at least three types of switching technology and therefore at least three different sets of switch generic software.⁴⁶ Thus, the analysis set forth in Figure 3 must be incomplete. Moreover, since switch generic is technology specific, it is difficult to imagine how Arthur Andersen could have distinguished variation due to switch generic from variation due to switch technology.

On this subject, Arthur Andersen's observations again appear to be inaccurate:

The vintage of software versions can be a very significant factor, especially in cases where a substantive change in switch configuration was made by the vendor from one release to the next. For example, a switch software change that moves from centralized to decentralized processing can have a very significant effect on the cost of certain BSE features. The use of model versions with old vendor prices also has an impact on investment estimates.⁴⁷

⁴⁶See Arthur Andersen, Appendix 23 at 4,36, Figure 4A.

⁴⁷Arthur Andersen, at 16.

In the case of both ANI and multiline hunt group⁴⁸ there is virtually no variance attributable to switch generic software or switch configuration; thus from Arthur Andersen's analysis one can only conclude that use of old models with old prices has produced the second most important source of ANI cost variation.

⁴⁸Arthur Andersen, Appendix 24, at 3.

Figure 3

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Figure 3 (Continued)

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Lack of Sensitivity Analysis: Aggregation

The BSE cost values filed by the BOCs in their TRPs are weighted averages across technology types (and states, in multi-state companies). Arthur Andersen acknowledges the importance of the weighting scheme noting that:

The differences in demand variables [used as weights] will likely introduce differences due to aggregation methods rather than real technology differences.⁴⁹

As can be seen in Table 4, there are numerous differences in the weighting schemes employed.⁵⁰ Arthur Andersen concludes that "Ameritech, Bell Atlantic and Nevada Bell used demand variables which seem to come close to desirable surrogates for feature usage",⁵¹ however, no sensitivity analysis is performed to investigate the magnitude of cost differences which are due to the BOCs' choice of weighting scheme.

WillTel agrees with Arthur Andersen that the most proper weighting method is that based on feature usage. In the case of ANI, feature usage is most accurately measured by the number of calling billing number delivery attempts. Allowing the BOCs to base their weighting on a method of their choice is unreasonable since the method chosen should be that which conforms most closely to the manner in which costs are incurred. Further investigation of the impact of weighting scheme on BSE reported costs is clearly needed.

⁴⁹Arthur Andersen, at 100.

⁵⁰Arthur Andersen, Appendix 26, at 6.

⁵¹Id.

Table 4

WEIGHTING SCHEMES FOR ANI	
BOC	WEIGHTING SCHEME
AMERITECH	Forecasted ANI attempts
BELL ATLANTIC	Trunkside Interstate MOU
BELL SOUTH	*
NEW YORK TELEPHONE	*
NEW ENGLAND TELEPHONE	*
NEVADA BELL	1990 FGD MOU
PACIFIC BELL	3-year projections of line additions
SOUTHWESTERN BELL	# Access lines
U S WEST	**

* BellSouth and New England Telephone separately merged office data for all their states into one model office study for each switch technology. Therefore post-SCIS state weightings are not applicable.

** U S WEST used average company data to calculate one set of unit investments for each switch technology. Therefore post-SCIS state weightings are not applicable.

Summary of Arthur Andersen Review

The Arthur Andersen study, as shown in the examples above, is misleading and imprecise in many instances. It does not allow the reviewer to distinguish between differences in cost due to underlying cost characteristics and those due to BOC discretion. The use of statistical concepts is both erroneous and misleading. Therefore, Arthur Andersen's conclusions concerning the appropriateness of cost methodology, as well as its empirical conclusions regarding sensitivity analysis, should be given no weight in this proceeding. Finally since no audit of the input data has been

performed, one can draw no inferences from the Arthur Andersen study as to the accuracy of the cost estimates provided by SCIS.

IV. Conclusions

The analysis presented above reveals numerous and serious deficiencies in the ONA costing and review processes. These deficiencies, not underlying cost differences, have led to the "wide disparity in rate levels of BSEs among the BOCs,"⁵² which the FCC has noted as a principal concern in this proceeding.

The key source of these deficiencies is the unreasonable latitude which the BOCs have been given to manipulate the costing process. It is difficult to characterize the SCIS/SCM process as a costing method at all, because the cost estimates presented are much more a function of BOC discretionary choices than of any underlying economic or engineering characteristics of the BOC networks. As Wiltel has demonstrated, the BOCs have used this discretion to render the costing process nearly useless as a basis for formulating efficient BSE rates:

Discretion to choose an improper costing methodology. By improperly selecting average costing, the majority of

⁵²ONA Investigation Order, 7 FCC Rcd 1512 (Com. Car. Bur. 1992).

carriers inflated their BSE cost estimates by several hundred percent.

Discretion to utilize non-representative input data. No audit has been performed to determine the accuracy of the engineering, price, vendor discount and traffic data used as inputs into the SCIS/SCM modelling process. Ameritech, for example, used 3-4 year old data to perform its study; even if the data were accurate in 1989 they may no longer be relevant indicators of current and future costs.

Discretion to use a technology mix not reflective of forward-looking incremental investment. Some carriers improperly included "backward-looking" analog technology in their studies. As calculated in Table 1, over 60% of total reported BSE costs are due to the improper inclusion of analog technology in the study samples of certain BOCs. If embedded costs are to be the basis for setting rates -- however inefficient -- there is no reason for the complexity and expense of SCIS and SCM.

Discretion to apply unreasonable overhead loadings to direct costs. When measured costs are small some BOCs have raised loadings so as to make unbundled costs appear more significant. BellSouth, which used the appropriate costing method (long-run marginal cost), added overhead

loadings which were more than two times greater than directly measured costs.

Discretion to use outdated versions of SCIS. Ameritech used an antiquated version of SCIS which was probably less refined than the current version and certainly biased cost estimates by employing old technology prices.

Discretion to choose an aggregation process. Different aggregation methodologies will result in different BSE cost estimates, and vary in the degree to which they reflect BSE feature usage. The BOCs have utilized a number of different methodologies, not all of which accurately reflect feature usage.

In addition to these methodology and input choices, BOCs have discretion to mark prices up above feature costs.

For purposes of setting efficient prices, constraining the BOCs' from utilizing their monopoly positions to engage in anticompetitive practices, and encouraging innovation and growth in the enhanced services market, this level of latitude is clearly unreasonable and should not be tolerated. We urge the Commission to recognize that the majority of the costing information submitted to date is simply irrelevant to achieving the Commission's established goals; similarly the review process has yielded very little information, except to the extent it reveals the tremendous impact of certain BOC methodology choices.

WilTel, as a consumer of BOC access services, is also concerned that this proceeding has taken a turn not envisioned when the ONA proceeding began: the unbundling of feature groups. However, even if the Commission does decide in favor of such unbundling in principle, it must ensure that BSEs are priced based on their economic costs -- not at prices set by the BOC monopolies. Without implementation of the recommendations which follow, unbundling of feature groups or other BSEs should not proceed.

V. Recommendations

Serious deficiencies exist in the ONA process; significant steps must be taken to ensure that the Commission's goals of, efficient, non-discriminatory rates which promote expansion of the ESP market and limit the BOCs' ability to engage in monopoly pricing, are realized.

First, the Commission must adopt methodological standards for the performance of cost studies. As discussed earlier, long-run marginal cost is the only methodology compatible with attaining the Commission's goals for feature group unbundling because it is the only methodology capable of identifying the incremental cost associated with particular switching features and, therefore, the only basis for setting efficient rates on the principle of cost-causation. Based on a very limited inspection of the long-run marginal costing option in the SCIS model, its assumptions and procedures appear both adequate and correct provided that relevant input data are used.

Second, the Commission should adopt costing standards for each of the areas listed in the Conclusion section above. Use of outdated SCIS/SCM models and prices, old data, embedded technology, and wide-ranging input assumptions must be forbidden if the costing process is to be meaningful.

Third, an independent audit (rather than a review of limited scope and doubtful analytical worth) is required to determine the validity and authenticity of the input data used by the BOCs in the costing process.

Fourth, the Commission should ensure that concerned parties have access to materials relevant to reviewing the costing process. The Arthur Andersen review, while a useful starting point, is insufficient.

Finally, when costs are finally calculated in a consistent and economically meaningful manner, WilTel urges the Commission to adopt a cost/benefit approach to unbundling. If accurately measured, the incremental costs of unbundling ANI are so minuscule that they are exceeded by the measurement, billing, unbundling, and adjustment costs, then unbundling should not be mandatory.

WILLIAMS TELECOMMUNICATIONS
GROUP, INC.



Joseph W. Miller

Its Attorney

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Suite 3600
P.O. Box 2400
One Williams Center
Tulsa, Oklahoma 74102
(918) 588-2108